

Amendments to the Title:

Please replace the title with the following:

REPEAT FIELD ~~DETECTION-DEVICE~~ DETECTING APPARATUS, VIDEO PROGRESSIVE CONVERSION
REPRODUCING APPARATUS, REPEAT FIELD DETECTING METHOD, PROGRAM, AND RECORDING
MEDIUM

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Amendments to the Specification:

Please add the following new paragraph after the Title and before the first paragraph on page 1:

THIS APPLICATION IS A U.S. NATIONAL PHASE APPLICATION OF PCT INTERNATIONAL APPLICATION PCT/JP2003/014294.

Please replace the paragraph, beginning at page 8, line 3, with the following rewritten paragraph:

~~Present Invention 1~~The first aspect of the present invention is a repeat field detecting apparatus which is used in a video progressive conversion reproducing apparatus of converting a video input signal of interlace scheme into a video signal of progressive scheme and which detects whether said video input signal is a repeat field where the same video image is outputted repeatedly or an ordinary field which is other than said repeat field, said repeat field detecting apparatus comprising:

Please replace the paragraph, beginning at page 9, line 8, with the following rewritten paragraph:

~~This invention reduces the~~The probability of performing false progressive conversion is reduced, so as to improve the image quality of the output video image processed by video progressive conversion.

Please replace the paragraph, beginning at page 9, line 11, with the following rewritten paragraph:

~~Present Invention 2~~The second aspect of the present invention is a repeat field detecting apparatus according to ~~Present Invention 1~~the first aspect of the present invention, wherein

Please replace the paragraph, beginning at page 9, line 17, with the following rewritten paragraph:

~~Present Invention 3~~The third aspect of the present invention is a repeat field detecting apparatus according to ~~Present Invention 1~~the first aspect of the present invention, wherein

Please replace the paragraph, beginning at page 9, line 22, with the following rewritten paragraph:

~~Present Invention 4~~The fourth aspect of the present invention is a repeat field detecting apparatus according to ~~Present Invention 1~~the first aspect of the present invention, wherein said M/N ratio adaptive repeat field confirming means determines the field as an ordinary field until five fields have elapsed from the initial state, and wherein after five or more fields have elapsed from the initial state, said M/N ratio adaptive repeat field confirming means determines the field as an ordinary field when the output of said RF determination reliability calculating means is smaller than a predetermined threshold value, and sets the output of said first RF determining means as the determination result when the output of said RF determination reliability calculating means is greater than or equal to said predetermined threshold value.

Please replace the paragraph, beginning at page 10, line 9, with the following rewritten paragraph:

~~In this invention, an~~An M/N ratio is calculated and used as an index indicating the reliability of the repeat field detection. When the M/N ratio is smaller than or equal to a predetermined threshold value, the repeat field determination result is not reliable, and hence the field is treated as an ordinary field. That is, when the possibility of being a repeat field is small, a filtering process for ordinary fields is performed, so that the probability of performing false progressive conversion is reduced. This improves the image quality of the output video image processed by video progressive conversion.

Please replace the paragraph, beginning at page 10, line 20, with the following rewritten paragraph:

~~Present Invention 5~~The fifth aspect of the present invention is a repeat field detecting apparatus according to ~~Present Invention 1~~the first aspect of the present invention, wherein said M/N ratio calculating means comprises:

Please replace the paragraph, beginning at page 11, line 16, with the following rewritten paragraph:

~~In this invention, the~~The calculation of the M/N ratio is performed at the shortest period of the latest five fields. This permits the M/N ratio to be calculated in a manner capable of following rapidly the change in the video image. This reduces the delay in the determination result and shortens the duration in which false progressive conversion is performed. This reduces the probability of performing the false progressive conversion, so as to improve the image quality of the output video image processed by video progressive conversion.

Please replace the paragraph, beginning at page 11, line 25, with the following rewritten paragraph:

~~Present Invention 6~~The sixth aspect of the present invention is a repeat field detecting apparatus according to ~~Present Invention 1~~the first aspect of the present invention, wherein said RF determination reliability calculating means returns a value indicating the reliability of said first RF determining means corresponding to the output value of said M/N ratio calculating means, on the basis of previously-obtained information indicating the relation between the reliability of said first RF determining means and the output of said M/N ratio calculating means and on the basis of the output provided from said M/N ratio calculating means.

Please replace the paragraph, beginning at page 12, line 10, with the following rewritten paragraph:

~~In this invention, the~~The relation between the M/N ratio obtained from the video input signal and the reliability of the incorporated RF determining means is measured in advance. Then, on the basis of the M/N ratio of the video input signal to be processed by video progressive conversion, an index indicating the reliability of the output of the RF determining means at the time of conversion is obtained and used. This improves repeat field detection accuracy, and hence reduces the probability of performing the false progressive conversion, so as to improve the image quality of the output video image processed by video progressive conversion.

Please replace the paragraph, beginning at page 12, line 21, with the following rewritten paragraph:

~~Present Invention-7~~The seventh aspect of the present invention is a repeat field detecting apparatus according to ~~Present Invention-1~~the first aspect of the present invention, wherein said first RF determining means comprises:

Please replace the paragraph, beginning at page 13, line 20, with the following rewritten paragraph:

~~In this invention, the~~The discrepancy pixel numbers are averaged out at the same period position n ($n=1$ through 5). As a result, in a period position corresponding to a repeat field, the discrepancy pixel number stays always small. In other period positions, depending on the difference in the input video signal, the discrepancy pixel number becomes large in a scene having large motion, and becomes small in a scene having little motion, so as to be averaged out. Thus, the n -th discrepancy pixel number not located at the repeat field position has an averaged value larger than the discrepancy pixel number. This makes clear the difference between the discrepancy pixel numbers even in a scene having little motion, and hence permits easy identification of the position of the repeat field. This improves the repeat field detection accuracy, and hence reduces the probability of performing false progressive conversion, so as to improve the image quality.

Please replace the paragraph, beginning at page 14, line 11, with the following rewritten paragraph:

~~Present Invention-8~~The eighth aspect of the present invention is a repeat field detecting apparatus according to ~~Present Invention-7~~the seventh aspect of the present invention, comprising

Please replace the paragraph, beginning at page 15, line 5, with the following rewritten paragraph:

~~In this invention, the~~The first through n -th accumulated averaging means are initialized at each time when a scene change is detected. This permits such correction that the positional

deviation of a repeat field which can occur at a scene change which is an editing point of the video input signal is prevented from mixing into the first through fifth accumulated averaging means. This reduces the probability of occurrence of false determination which occurs when the repeat field position changes at the editing point. This permits accurate identification of the repeat field position, and hence reduces the probability of performing false progressive conversion, so as to improve the image quality.

Please replace the paragraph, beginning at page 15, line 17, with the following rewritten paragraph:

~~Present Invention-9~~The ninth aspect of the present invention is a repeat field detecting apparatus which is used in a video progressive conversion reproducing apparatus of converting a video input signal of interlace scheme into a video signal of progressive scheme and which detects whether said video input signal is a repeat field where the same video image is outputted repeatedly or an ordinary field which is other than said repeat field, said repeat field detecting apparatus comprising:

Please replace the paragraph, beginning at page 17, line 9, with the following rewritten paragraph:

~~In this invention, the~~The repeat field detecting means used is M/N ratio adaptive composite RF determining means. This improves the repeat field detection accuracy. Further, the long term M/N ratio indicating the motion and the noise characteristics in each scene of the input video signal is calculated and used as an index for scene change detection and as an index for repeat field determination result. This avoids that the field is determined as if an ordinary field on the basis of a temporary decrease in the motion. Accordingly, this reduces the probability of performing false progressive conversion, so as to improve the image quality.

Please replace the paragraph, beginning at page 17, line 20, with the following rewritten paragraph:

~~Present Invention-10~~The tenth aspect of the present invention is a repeat field detecting apparatus according to ~~Present Invention-9~~the ninth aspect of the present invention, wherein

Please replace the paragraph, beginning at page 17, line 24, with the following rewritten paragraph:

said at least a pair of fields are ~~pairs of four adjacent fields~~one or more pairs of fields among four pairs of fields which adjoin the arbitrary pair of fields which measure a M/N ratio.

Please replace the paragraph, beginning at page 18, line 1, with the following rewritten paragraph:

~~Present Invention 11~~The eleventh aspect of the present invention is a repeat field detecting apparatus according to ~~Present Invention 9~~the ninth aspect of the present invention, wherein

Please replace the paragraph, beginning at page 18, line 6, with the following rewritten paragraph:

~~Present Invention 12~~The twelfth aspect of the present invention is a repeat field detecting apparatus according to ~~Present Invention 9~~the ninth aspect of the present invention, wherein said M/N ratio adaptive composite RF determining means comprises:

Please replace the paragraph, beginning at page 20, line 4, with the following rewritten paragraph:

~~This invention uses the~~The first through fourth repeat field means are used each having different determination characteristics. These means are: prior art means of calculating the repeat field on the basis of the comparison between a fixed value and the discrepancy pixel number; prior art means of calculating the repeat field on the basis of the comparison with the preceding discrepancy pixel number; new means of calculating the repeat field by using the first through fifth accumulated averaging means; and new means of calculating the repeat field on the basis of an M/N-ratio dependent threshold value and the discrepancy pixel number, so as to improve the repeat field detection accuracy. In addition to the results of these means, used is the reliability obtained from the M/N ratio. This permits more reliable repeat field determination result, and hence reduces the probability of performing false progressive conversion, so as to improve the image quality.

Please replace the paragraph, beginning at page 20, line 20, with the following rewritten paragraph:

~~Present Invention 13~~The thirteenth aspect of the present invention is a repeat field detecting apparatus according to ~~Present Invention 12~~the twelfth aspect of the present invention, wherein said m-th ($m=1$ through 4) M/N ratio adaptive RF determination value means outputs a value which is a predetermined and recorded value corresponding to the output of the M/N ratio calculating means and indicating the reliability of the m-th RF determining means, and which is positive for a repeat field and is negative for an ordinary field, and further the absolute value of which indicates the reliability, wherein a large value indicates high reliability, while a small value indicates low reliability.

Please replace the paragraph, beginning at page 21, line 5, with the following rewritten paragraph:

~~This invention improves the~~The repeat field detection accuracy is improved, and hence reduces the probability of performing false progressive conversion, so as to improve the image quality of the output video image processed by video progressive conversion.

Please replace the paragraph, beginning at page 21, line 9, with the following rewritten paragraph:

~~Present Invention 14~~The fourteenth aspect of the present invention is a repeat field detecting apparatus according to ~~Present Invention 9~~the ninth aspect of the present invention, wherein said long term M/N ratio calculating means comprises:

Please replace the paragraph, beginning at page 22, line 17, with the following rewritten paragraph:

~~In this invention, the~~The long term M/N ratio which is an M/N ratio in a long term between a scene change and another scene change is calculated and used. Without this invention, the detection of temporary image degradation reduces the M/N ratio even when a repeat field is in continuation and even when the repeat field position does not vary. This causes the repeat field to be detected as if an ordinary field. However, this invention reduces

the probability of such false determination, and hence reduces the probability of performing false progressive conversion, so as to improve the image quality of the output video image processed by video progressive conversion.

Please replace the paragraph, beginning at page 23, line 3, with the following rewritten paragraph:

~~Present Invention 15~~The fifteenth aspect of the present invention is a repeat field detecting apparatus according to ~~Present Invention 14~~the fourteenth aspect of the present invention, wherein said M/N ratio adaptive scene change detecting means compares the absolute value of the difference between said discrepancy pixel number and said long term M component with said M/N-ratio dependent threshold value, then determines the scene as a continuous scene when said absolute value is smaller than the threshold value, and determines the scene as a scene change when said absolute value is greater than or equal to the threshold value.

Please replace the paragraph, beginning at page 23, line 12, with the following rewritten paragraph:

~~In this invention, the~~The threshold value for scene change determination is varied depending on the long term M component and the long term M/N ratio, so as to improve the scene change detection accuracy. Without this invention, the detection of temporary image degradation reduces the threshold value for scene change determination even when the scene is in continuation. This causes the continuous scene to be determined as if a scene change. Thus, in the following processes, the field is determined as if an ordinary field, and hence false progressive conversion is performed. However, this invention reduces the probability of the occurrence of the problem of performing such false progressive conversion, so as to improve the image quality.

Please replace the paragraph, beginning at page 23, line 24, with the following rewritten paragraph:

~~Present Invention 16~~The sixteenth aspect of the present invention is a video progressive conversion reproducing apparatus comprising:

Please replace the paragraph, beginning at page 24, line 1, with the following rewritten paragraph:

a repeat field detecting apparatus according to ~~Present Invention 8~~the eighth aspect of the present invention;

Please replace the paragraph, beginning at page 25, line 3, with the following rewritten paragraph:

~~In this invention, the~~The threshold value for the detection duration for the determination that a motion picture composition filter is to be set is varied depending on the M/N ratio. That is, when the repeat field determination has high reliability, the motion picture composition filter is set after a short time. In contrast, when the repeat field determination has low reliability, the motion picture composition filter is set after the determination as motion picture material continues for a long time. This improves both the follow of filter switching and the reliability of accurate filter setting, so as to improve the image quality.

Please replace the paragraph, beginning at page 25, line 14, with the following rewritten paragraph:

~~Present Invention 17~~The seventeenth aspect of the present invention is a video progressive conversion reproducing apparatus comprising:

Please replace the paragraph, beginning at page 25, line 16, with the following rewritten paragraph:

a repeat field detecting apparatus according to ~~Present Invention 15~~the fifteenth aspect of the present invention;

Please replace the paragraph, beginning at page 26, line 18, with the following rewritten paragraph:

~~In this invention, the~~The threshold value for the detection duration for the determination that a motion picture composition filter is to be set is varied depending on the long term M/N

ratio. That is, when the repeat field determination has high reliability, the motion picture composition filter is set after a short time. In contrast, when the repeat field determination has low reliability, the motion picture composition filter is set after the determination as motion picture material continues for a long time. This improves both the follow of filter switching and the reliability of accurate filter setting, so as to improve the image quality.

Please replace the paragraph, beginning at page 27, line 4, with the following rewritten paragraph:

~~Present Invention 18~~The eighteenth aspect of the present invention is a video progressive conversion reproducing apparatus according to ~~Present Invention 16 or 17~~the sixteenth or seventeenth aspect of the present invention, comprising:

Please replace the paragraph, beginning at page 27, line 25, with the following rewritten paragraph:

~~This invention provides an~~An effect is provided that when an irregular video input signal is obtained such that the material determination result varies continuously, continuous filter variation is suppressed, so that the image quality is improved. Further, the filter variation allowable limit and the depth d of filter change history can be changed, so that the sensitivity can be adjusted.

Please replace the paragraph, beginning at page 28, line 7, with the following rewritten paragraph:

~~Present Invention 19~~The nineteenth aspect of the present invention is a repeat field detecting method which is used in a video progressive conversion reproducing apparatus of converting a video input signal of interlace scheme into a video signal of progressive scheme and which detects whether said video input signal is a repeat field where the same video image is outputted repeatedly or an ordinary field which is other than said repeat field, said repeat field detecting method comprising:

Please replace the paragraph, beginning at page 29, line 12, with the following rewritten paragraph:

~~Present Invention 20~~The twentieth aspect of the present invention is a repeat field detecting method which is used in a video progressive conversion reproducing apparatus of converting a video input signal of interlace scheme into a video signal of progressive scheme and which detects whether said video input signal is a repeat field where the same video image is outputted repeatedly or an ordinary field which is other than said repeat field, said repeat field detecting method comprising:

Please replace the paragraph, beginning at page 31, line 4, with the following rewritten paragraph:

~~Present Invention 21~~The twenty-first aspect of the present invention is a program of causing a computer to serve as:

Please replace the paragraph, beginning at page 31, line 24, with the following rewritten paragraph:

M/N ratio adaptive repeat field confirming means of confirming the output of said first RF determining means as the determination result on the basis of said reliability outputted from said RF determination reliability calculating means; in a repeat field detecting apparatus according to ~~Present Invention 1~~the first aspect of the present invention.

Please replace the paragraph, beginning at page 32, line 5, with the following rewritten paragraph:

~~Present Invention 22~~The twenty-second aspect of the present invention is a program of causing a computer to serve as:

Please replace the paragraph, beginning at page 33, line 9, with the following rewritten paragraph:

M/N ratio adaptive repeat field confirming means of confirming the output of said first RF determining means as the determination result on the basis of said reliability outputted from said RF determination reliability calculating means; in a repeat field detecting apparatus according to ~~Present Invention 9~~the ninth aspect of the present invention.

Please replace the paragraph, beginning at page 33, line 15, with the following rewritten paragraph:

~~Present Invention 23~~The twenty-third aspect of the present invention is a computer-processable recording medium carrying a program according to ~~Present Invention 21 or 22~~the twenty-first or twenty-second aspect of the present invention.

Please replace the paragraph, beginning at page 59, line 15, with the following rewritten paragraph:

Figure 10 is a block diagram showing the configuration of the apparatus 247. In Figure 10, numeral 123 indicates a discrepancy pixel number input provided from the apparatus 304. Numeral 124 indicates a scene change detection result input from the apparatus 117. An apparatus 235 is an M/N ratio calculating apparatus similar to the apparatus 113 of Figure 1. An apparatus 236 is a first RF determining apparatus similar to the apparatus 112 of Figure 2. An apparatus 237 is a second RF determining apparatus of receiving the discrepancy pixel number, and then determining whether the field is a repeat field or not. An apparatus 238 is a third RF determining apparatus of receiving the discrepancy pixel number, and then determining whether the field is a repeat field or not. An apparatus 239 is a fourth RF determining apparatus of receiving the discrepancy pixel number, and then determining whether the field is a repeat field or not. An apparatus 240 is a first M/N ratio adaptive RF determination value means apparatus of outputting the reliability of the first RF determining means. Here, the reliability is determined on the basis of the M/N ratio outputted from the apparatus 235 according to the relation between the M/N ratio value and the reliability of the first RF determining means which is measured and recorded in advance. When the first RF determining means indicates a repeat field, the reliability value is positive. When the first RF determining means indicates an ordinary field, the reliability value is negative. Further, the degree of reliability is expressed by its absolute value. An apparatus 241 is a second M/N ratio adaptive RF determination value means apparatus of outputting the reliability of the second RF determining means. Here, the reliability is determined on the basis of the M/N ratio outputted from the apparatus 235 according to the relation between the M/N ratio value and the reliability of the second RF determining means which is measured and recorded in advance. When the first RF determining means indicates a repeat field, the reliability value is positive. When the first RF determining means indicates an ordinary field, the reliability value is negative. Further,

the degree of reliability is expressed by its absolute value. An apparatus 242 is a third M/N ratio adaptive RF determination value means apparatus of outputting the reliability of the third RF determining means. Here, the reliability is determined on the basis of the M/N ratio outputted from the apparatus 235 according to the relation between the M/N ratio value and the reliability of the third RF determining means which is measured and recorded in advance. When the first RF determining means indicates a repeat field, the reliability value is positive. When the first RF determining means indicates an ordinary field, the reliability value is negative. Further, the degree of reliability is expressed by its absolute value. An apparatus 243 is a fourth M/N ratio adaptive RF determination value means apparatus of outputting the reliability of the fourth RF determining means. Here, the reliability is determined on the basis of the M/N ratio outputted from the apparatus 235 according to the relation between the M/N ratio value and the reliability of the fourth RF determining means which is measured and recorded in advance. When the first RF determining means indicates a repeat field, the reliability value is positive. When the first RF determining means indicates an ordinary field, the reliability value is negative. Further, the degree of reliability is expressed by its absolute value. An apparatus 244 is an adder of adding the outputs of the apparatuses 240, 241, 242, and 243. An apparatus 245 is an M/N ratio adaptive composite repeat field detection threshold value which is a predetermined threshold value. An apparatus 246 is a comparator of comparing the threshold value stored in the apparatus 245 with the output of the apparatus 244, then determining the field as a repeat field if the output of the apparatus 244 is greater than or equal to the threshold value, and determining the field as an ordinary field if the output is smaller than the threshold value. The M/N ratio adaptive composite RF determining apparatus has such configuration. When a high possibility of being a repeat field is found from the RF determination result of the apparatus 236 and the M/N ratio outputted from the apparatus 235, a positive value having a large absolute value is obtained from the apparatus 240, while when a high possibility of being an ordinary field is found, a negative value having a large absolute value is obtained. When a high possibility of being a repeat field is found from the RF determination result of the apparatus 237 and the M/N ratio outputted from the apparatus 235, a positive value having a large absolute value is obtained from the apparatus 241, while when a high possibility of being an ordinary field is found, a negative value having a large absolute value is obtained. When a high possibility of being a repeat field is found from the RF determination result of the apparatus 238 and the M/N ratio outputted from the apparatus 235, a positive value having a large absolute value is obtained from the apparatus 242, while when a high possibility of being an ordinary field is found, a negative value having a

large absolute value is obtained. When a high possibility of being a repeat field is found from the RF determination result of the apparatus 239 and the M/N ratio outputted from the apparatus 235, a positive value having a large absolute value is obtained from the apparatus 243, while when a high possibility of being an ordinary field is found, a negative value having a large absolute value is obtained. Since the apparatus 244 adds the outputs of the apparatuses 240, 241, 242, and 243, the detection results strengthen each other if in the same direction, whereas the detection results cancel out each other if in the opposite directions. Thus, when a high possibility of being a repeat field is found, a positive value having a large absolute value is obtained, while when a high possibility of being an ordinary field is found, a negative value having a large absolute value is obtained. As a result, when this value is compared with the threshold value, the repeat field detection is carried out more reliably.

Please replace the paragraph, beginning at page 64, line 4, with the following rewritten paragraph:

Figure 12 is a block diagram showing the configuration of the apparatus 238. Numeral 123 indicates a discrepancy pixel number input provided from the apparatus 304. Numeral 250 indicates a previous discrepancy pixel storing apparatus of storing the discrepancy pixel number provided as the input 123. Numeral 251 indicates a comparator of comparing the discrepancy pixel number stored and delayed by one field in the apparatus 250 with the discrepancy pixel number provided as the input ~~223~~123, then determining the field as a repeat field if the latter discrepancy pixel number is smaller than or equal to the output of the apparatus 250, and determining the field as an ordinary field if the discrepancy pixel number is greater than the output of the apparatus 250. The system has such configuration.

Please replace the paragraph, beginning at page 64, line 17, with the following rewritten paragraph:

Figure 13 is a block diagram showing the configuration of the apparatus 239. Numeral 123 indicates a discrepancy pixel number input provided from the apparatus 304. Numeral 252 indicates an input of N component provided from the apparatus 235. Numeral 253 indicates an input of M/N ratio provided from the apparatus 235. Numeral 254 indicates an M/N ratio adaptive repeat field determination threshold value calculating apparatus of outputting a threshold value for repeat field detection which is determined and recorded in advance and

which corresponds to the M/N ratio, on the basis of the M/N ratio provided as the input 253. Numeral 255 indicates an adder of adding the N component provided as the input 252 to the output of the apparatus 254, and thereby calculating a final threshold value. Numeral 256 indicates a comparator of comparing the output of the apparatus 255 with the discrepancy pixel number provided as the input ~~223~~123, then determining the field as a repeat field if the discrepancy pixel number is smaller than or equal to the output of the apparatus 255, and determining the field as an ordinary field if the discrepancy pixel number is ~~smaller~~greater than the output of the apparatus 250. The system has such configuration.

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